IDAHO
DEPARTMENT OF FISH & GAME

Jerry M. Conley, Director

McCall Summer Chinook Salmon Hatchery

Annual Report

October 1, 1979 – September 30, 1980

Project 03-68-371

By

Larry Wimer
Fish Hatchery Superintendent II

December, 1980

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

McCall Summer Chinook Salmon Hatchery

ABSTRACT

Upon substantial completion of the new McCall facility, 128,000 summer chinook yearlings were transferred from Mackay State Hatchery to McCall. During April 1980, these fish numbered 124,800 and were planted in the South Fork Salmon River.

In October 1979 a total of 388,747 eyed eggs were received from Dworshak National Fish Hatchery. At the end of the fish year 301,490 resultant fingerlings remained for planting in April 1981. Approximately 120,000, in three separate lots, will be tagged for a vaccination study prior to liberation.

From 28 June to 3 July, 161 female and 80 male returning adult salmon were collected at Lower Granite Dam and trucked to Dworshak NFH. Approximately 100,000 eggs are anticipated from this source, to be shipped to McCall during October 1980.

During July, August and September 1980, a total of 186 1-ocean salmon and 194 2- and 3-ocean salmon returned to the South Fork trap. Approximately 45% of this run (including all coded-wire-tagged [CWT] or branded fish) were selected for spawning and the remainder released. Some 25 females were ponded and spawned, yielding 92,116 eggs. At the end of the fish year, 59,108 eyed eggs remained on station.

Two epizootics occurred in the McCall summer chinook. One was of an idiopathic nature that appeared to run its course and abate. The other was an infestation of Trychophrya sp. After many weeks of bioassays, it was found that an acetic acid dip would be the most effective course of action to take against this parasite.

A hatchery completion contract, to take care of original construction deficiencies, was awarded to D. **G.** Quinton Company, Inc. of Spokane, Washington.

Author:

Larry R. Wimer
Fish Hatchery Superintendent II

OBJECTIVES

The objectives of the McCall Hatchery are to:

1. Evaluate fish rearing capabilities of the new McCall facility.
2. Raise 1,000,000 summer chinook smolts for release in the South Fork Salmon River.
3. Trap and spawn a portion of the adult salmon returning to the South Fork Salmon River.
4. Collect data for CWT studies.
5. Propagate other species of fish for the State of Idaho, when facilities are available (Hutchinson 1980).

INTRODUCTION

Lower Snake River Compensation Plan and Project

The Lower Snake River Compensation Plan was designed to compensate the states of Idaho, Oregon, and Washington for losses of fish and wildlife caused by Ice Harbor, Lower Monumental, Little Goose, and Lower Granite Locks and Dams on the lower Snake River. The Lower Snake River Compensation Project will eventually, and in part, provide hatcheries in these states for the rearing of 9,160,000 chinook salmon smolts; 6,750,000 steelhead smolts and 42,184.8 kg (93,000 pounds) of resident fishery. McCall Summer.Chinook Hatchery is the first of these hatcheries.

McCall Hatchery

McCall Summer Chinook Hatchery, constructed by the Army Corps of Engineers, funded by the U. S. Department of Interior, Fish and Wildlife Service and operated by the Idaho Department of Fish and Game is located within the city limits of McCall, Valley County, Idaho, on the North Fork Payette River. The site is located approximately 0.4 km (1/4 mile) downstream from the Payette Lake regulating dam. Hatchery water is collected in Payette Lake at two inlets; one at the surface near the regulating dam, the other approximately 457 meters (1,500 feet) from shore at a depth of 15.25 meters (50 feet). These waters are combined for best temperature available at the mixing box just upstream of the regulating dam and delivered to the hatchery by way of a 76.2 centimeter (30 inch) diameter underground pipe. At full capacity the facility requires 0.56 m^3/S (20 cfs) of water. The State of Idaho has been granted a use permit for a maximum of 0.56 m^3/S (20 cfs) from the Lake Reservoir Company, owner of the dam. The fish rearing facilities of the hatchery include 26 eight-tray stacks of Heath incubators, two 0.53 m x 4.72 m (1.75 foot x 15.5 foot) fiberglass Heath troughs, 14 1.2 m x 12.1 m (4 foot x 40 foot) concrete vats, two 12.8 m x 60.9 m (42 foot x 200 foot) gravel bottom ponds and one 4.26 m x 32.0 m (14 foot x 105 foot) crowding basin. This hatchery has the capability of rearing 1,000,000 summer chinook salmon smolts to an approximate size of 7.7/kg (17.0/pound).

Trapping and Spawning Satellite Facility

The satellite trapping/spawning facility is located on the South Fork Salmon River near Cabin Creek, approximately 41.8 km (26 miles) east of Cascade, Valley County, Idaho. This facility consists of a removable fish weir, fish ladder, trap, two 3.0 m x 26.8 m (10 foot x 88 foot) adult holding ponds and a covered spawning area. Water is collected in the South Fork Salmon River 204 m (670 feet) upstream and delivered to the facility **in** a 83.3 centimeter (33 inch) diameter buried pipe. Adult holding capability of the satellite facility is 750 summer chinook. Returning adult salmon in excess of those required for hatchery operation are released in the South Fork above the fish weir for natural spawning. Until adequate numbers for both natural spawning and hatchery operation are reached, 50% of the run is returned to the river. Green eggs are transferred to McCall for incubation.

GENERAL FISH CULTURE AND HEALTH

Loading

Due to the low numbers of chinook eggs available, the incubators were loaded at a rate of 2,560 to 3,840 eggs per tray. After the accumulation of approximately 500 thermal units, the eggs were shocked and mortality removed using the salt flotation method described by Lietritz and Lewis (1974).

The fry were transferred to the vats after the accumulation of 1,650 thermal units. Rearing volumes in the vats can be established and changed by setting screens and drop gates at various elevations and distances along the vats. Densities in the vats and ponds were maintained at or below the Maximum Density Index (MDI) or Pond Loading Index (PLI) (Klontz 1979). Fish were transferred to the ponds when a size of 153.7 to 113.4/kg (350 to 250/pound) was achieved.

Hygiene

After eyeing, the eggs in the incubators are cleaned every three to four days by flushing the trays and spraying off the lid screens. The vats are cleaned daily using brushes and the vat mortality is picked, recorded and disposed of properly at 0800 and 1700. The gravel bottom ponds have concrete aprons covering the last 9.14 m (30 feet) of the bottoms. This area is cleaned, as needed, by use of a pond vacuum with effluent discharged in a supernating tank, in line above the hatchery settling pond. Pond mortality is taken care of in the same manner as that of the vats.

Each hatchery vat has a cleaning brush and net designated for use at that vat only. After each day's use, vat brushes and nets are disinfected in 600 ppm Benzalkonium Chloride 50% overnight.

Water Quality and Temperature

At the mixing box, water from the surface and deep inlets is combined to achieve the best temperature available (Appendix A). During the summer months, cooler, deep water is mixed with the warm surface water to maintain a temperature of 11 to 13 C (52 to 55 F). During the winter months, the water of the deep inlet is used exclusively. Surface water can be used in the winter to eliminate freezing of the surface inlet structure or if oxygen deficiencies occur at the deep inlet.

Some 95 ml water samples are taken from both inlets each week and fixed with 5 ml Nitric Acid. These samples are analyzed for heavy metals concentrations by the Department of Lands, Bureau of Mines and Geology, Moscow, Idaho (Appendix B).

Feed Type, Sizes, Amounts and Feeding Frequency

OMP Formula II fish feed, produced by Moore-Clark Company, La Conner, Washington, is used exclusively for salmon nutrition. Sizes of feed utilized varies from Starter Mash to 1/8 inch pellets. Until sufficient historical data is collected, the Moore-Clark feed chart will be used in determining feeding schedules. First feeding fry are fed 12 to 16 times per day with varying ratios of Starter Mash and 1/32 inch pellets. As fish grow, feed size increases and feeding frequencies decrease to, but never fall below, four times per day.

Inventories

Hatchery populations are investigated on a regular basis to check length/weight relationships, adjust feeding levels, measure MDI and PLI, and insure a healthy product by way of a thorough necropsy. Representative samples from each vat or pond are weighed in water and counted on the 1st and 15th of each month. On the 1st of each month total lengths are measured on similar samples. Necropsies are performed on a few fish at the start of each month (Appendix C).

Disease Prophylaxis

Upon receipt of eggs at the McCall Hatchery, the entire shipment is disinfected in a 1:300 solution of Wescodyne for 10 minutes. Sufficient baking soda is added to produce a 0.05% concentration of sodium bicarbonate in the 1:300 solution, as a buffering agent against the acidifying effects of Wescodyne in soft water (Wood 1974).

Ultraviolet water purification systems are employed on waters to incubators and first feeding fry. However, as an added protection against fungal involvement, eggs are treated with malachite green flushes. The flush treatment consists of pouring 60 ml of a stock solution, made up by dissolving 42.5 gm (1.5 ounces) malachite green **in** 3.785 1 (1 gallon) of water, into the top tray of each incubator stack. This treatment is repeated every four to five days. A 0.5 ppm, one hour treatment of inflowing water is also flushed through rearing ponds after CWT operation is completed at McCall. This treatment is administered to combat fungal development at the site of the clipped adipose fin, is continued on a once a week basis, and is terminated after five weeks.

BROOD YEAR 1978

Production

In November, 128,000 (3,175.2 kg, 7,000 pounds) yearling chinook salmon were transferred to McCall from Mackay State Hatchery. These fish were the product of adults trapped at Little Goose Dam, held and spawned at Rapid River Hatchery and shipped, as eggs, to Mackay and McCall State Hatcheries. Those at McCall were transferred to Mackay in February 1979 so construction could begin on the new McCall Hatchery.

When returned to McCall, the Mackay reared fish numbered 41,600, 1,814.4 kg (4,000 pounds) at 22.9/kg (10.4/pound). Those reared at McCall and Mackay numbered 86,400, 1,360.8 kg (3,000 pounds) at 63.5/kg (28.8/pound).

The electrical system at the new hatchery was not completed at time of arrival and since this was such an atypical group of fish, no tagging operation was conducted.

On 21, 22 and 23 April, the 1978 brood year was transferred to the South Fork Salmon River. At plant time the fish numbered 124,800, 4,354.5 kg (9,600 pounds) at 28.6/kg (13.0/pound) (Table 1).

Feed Conversion

To produce the 1,179.3 kg (2,600 pounds) of fish in this brood year, a total of 2,200 kg (4,850 pounds) OMP II fish food was utilized. Resulting in a conversion ratio (kg feed/kg fish) of 1.865 (Table 2).

Disease

No disease manifested itself in the 1978 brood year fish. A loss of 2,560 fish occurred **in** this group of fish during the first week at McCall. This loss is directly attributed to transportation and acclimation to the new environment.

BROOD YEAR 1979

Production

On 9, 19 and 29 October a total of 429,531 eggs were received from Dworshak/ Kooskia NFH Complex. These eggs were the product of adult summer chinook trapped at Lower Granite Dam on 15, 16 and 17 July 1979 and trucked by NMFS personnel to Dworshak for holding and spawning. After shocking and salt picking (one lot was shipped unpicked - as requested), 388,747 eyed eggs were placed in Heath incubators. At the close of the fish year, 301,490 fingerlings, 3,136.6 kg at 96.1/kg (6,915 pounds at 43.6/pound) are on hand at McCall for release during April 1981 (Table 1).

Conversion

Some 5,660.9 kg (12,480 pounds) of OMP II feed in various sizes were required to produce the 3,136.6 kg (6,915 pounds) of fish in this group. Utilization of feed at this rate produced a conversion ratio of 1.804 (Table 2).

Disease

Two epizootics manifested themselves in the 1979 brood year fish. The first occurred in May and was idiopathic in nature, best described by Wood (1974) as clubbed gills "dropout" disease. Pathologists from Idaho, Montana and Utah investigated the problem but the causative agent was not found. The outbreak appears to hit as temperature increases from the winter low of 3.3 C (38 F), progressing from the first lot through the last in a chronological order. Some spiraling along the long axis is noted from swim-up to outbreak, but never enough to cause alarm.

Table 1. Fish year production

Brood Year	Numbers Produced	Kilograms Produced	Pounds Produced
1978	124,800*	(net)1,179.36	(net)2,600
1979	301,490	3,136.64	6,915
Fish year total	426,290	4,316.00	9,515

* 128,000 transferred from Mackay State Hatchery

Table 2. Fish year feed cost per unit of fish produced.

Brood Year	kg of Fish Produced (lbs)	kg of Feed Used (lbs)	Feed Cost	C.	Fish Feed Cost/kg (lb) of Fish Produced
1978	1,179.36(2,600)	2,200(4,850)	$1,542.30	1.86	1.30 (.593)
1979	3,136.60(6,915)	5,661(12,480)	$4,153.44	1.80	1.32 (.600)
Fish Year Total	4,316.00(9,515)	7,861(17,330)	$5,695.74	1.82	1.319(.598)

When the epizootic hits, affected fish become very lethargic, swim on their sides in a "sleepy" manner, go off feed and die. Vats have good flow through them (3-4 turnovers/hour) and are cleaned daily. Brushes are disinfected in 600 ppm Benzalkonium Chloride 50% overnight, and are never transferred from one vat to another. Gills were first thought to be the only problem area and various lots were treated with astringents (salt at 1% and 2%, 40-minute baths; Cutrine plus at 29.57 and 59.14 ml/28.32 1^3 S [1 and 2 liquid ounce/cfs], 60-minute drips; and $KMn0_4$ at 1 ppm 60-minute drips) in an attempt to reduce the swelling in the gills. None of these treatments were effective. A bacterial invasion Aeromonas sp. or Pseudomonas sp. was discovered and considered to be a secondary invasion. A treatment of TM 50 at 36 gm/45.36 kg (100 pounds) of fish was administered for 14 days.

The second epizootic, a gill infestation of Trychophrya sp., occurred in August. No appreciable mortality (60/month of approximately 301,000) was caused by the outbreak but elimination of the parasite was desirable to avoid a population explosion in the fish when the water warms and the fish smolt, next spring. Two months of bioassays followed. Bioassays of Malachite green at 1 ppm; Benzalkonium Chloride 50% at 2 ppm; formalin at 1 ppm, 160 ppm (two treatments), and 250 ppm (two treatments); copper sulfate at 0.93 ppm; and Diquat at 2 ppm and 4 ppm active ingredient were conducted on these fish as one hour drips. Salt baths of 3%, 5% and 7.5%, until stress, were also tried. None of these treatments were effective. A bioassay of reagent grade acetic acid (99.5%) at a solution of 1:250 (4,000 ppm) administered as a one minute dip produced good results. The entire year class of fish will be dipped in early October.

ADULT RETURNS AND BROOD YEAR 1980

Trapping, Holding and Egg Take

From 28 June to 3 July, 161 female and 80 male adult summer chinook were selected at Lower Granite Dam and transported, by NMFS personnel, to the Dworshak/Kooskia NFH Complex for holding and spawning. These fish were injected with Erythro-200 (Abbott) at a rate of 5.0 mg active ingredient per 0.4536 kg (pound). A suspected adverse reaction to the Erythromycin injections administered at the dam caused a considerable mortality early in the holding period. Subsequent uncontrollable fungal involvement due to the trucking of these fish caused a further decline in the numbers of these chinook. Only 28 females survived to spawn. Wayne Olson (personal contact) has stated that approximately 100,000 eggs will be ready for pick-up early in October.

On 19 July, trapping of summer chinook began on the South Fork. Before the project was terminated, on 10 September, 186 1-ocean (jack) chinook and 194 2-ocean and 3-ocean chinook were trapped (Figure 1). Some 88 of the 2- and 3-ocean fish and 117 of the 1-ocean fish were released upstream at the time of trapping. During spawning operations, an additional 10 2- and 3-ocean males and 15 1-ocean males were released. Length frequencies of all fish except those immediately released were recorded at subsequent release or time of spawning (Figure 2). One 2-ocean male and three 1-ocean male trap mortalities were experienced. During the holding period, five 2- and 3-ocean males and two 1-ocean males died to unknown causes.

Of the fish initially ponded there were 25 females. No mortality occurred in the females.

Figure 1. Timing of returning salmon to South Fork trap.

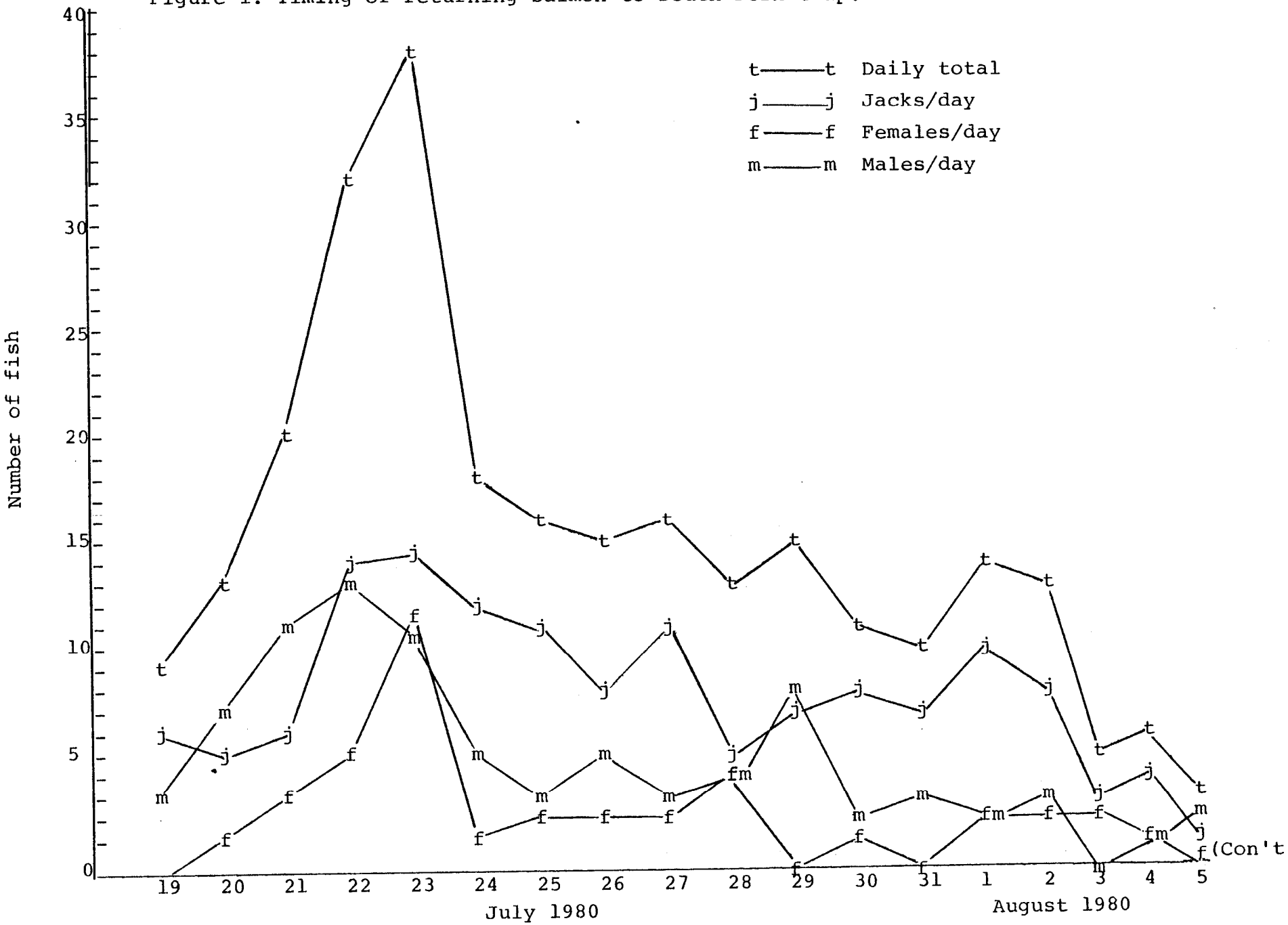


Figure 1 (Con't). Timing of returning salmon to South Fork trap.

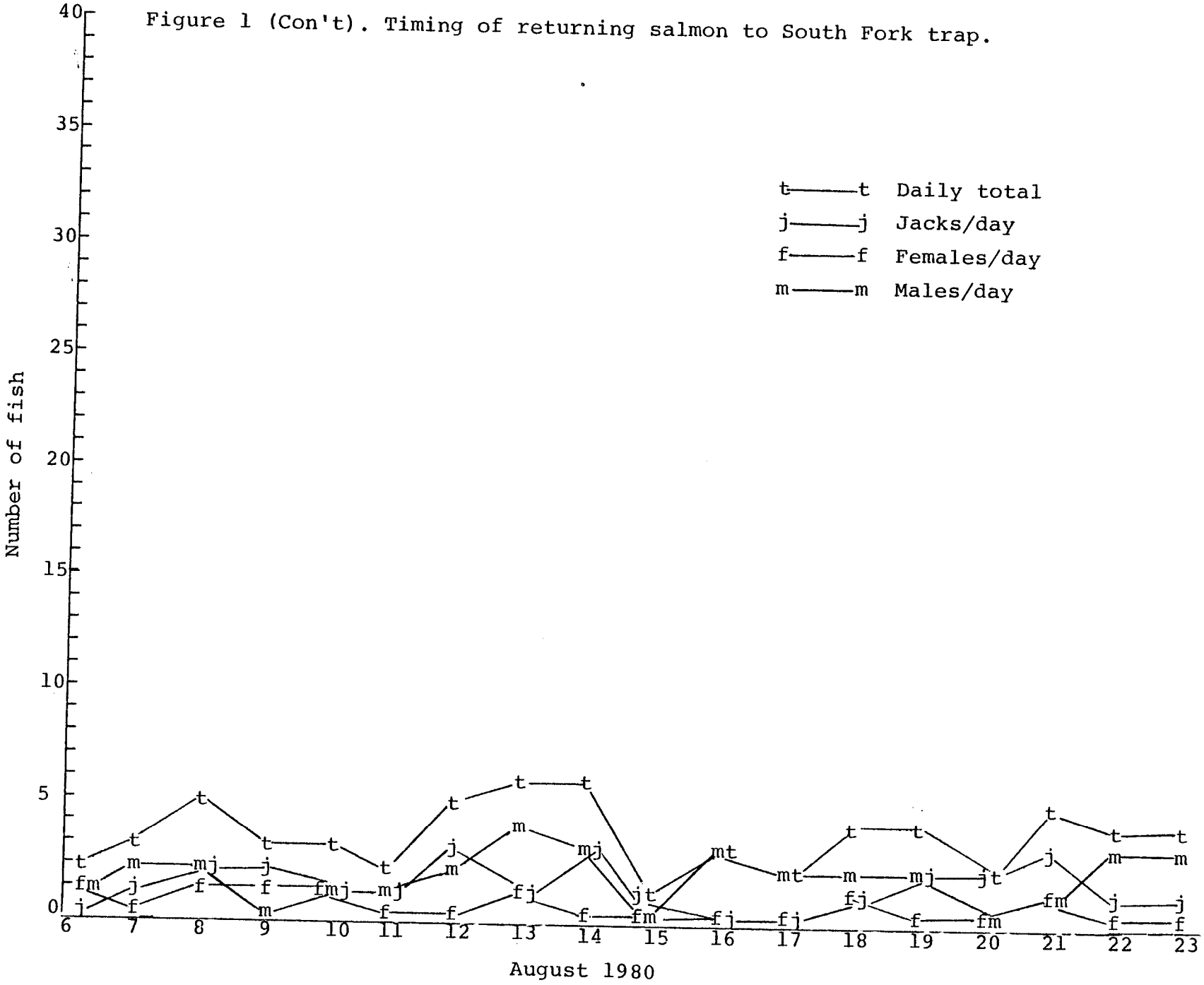
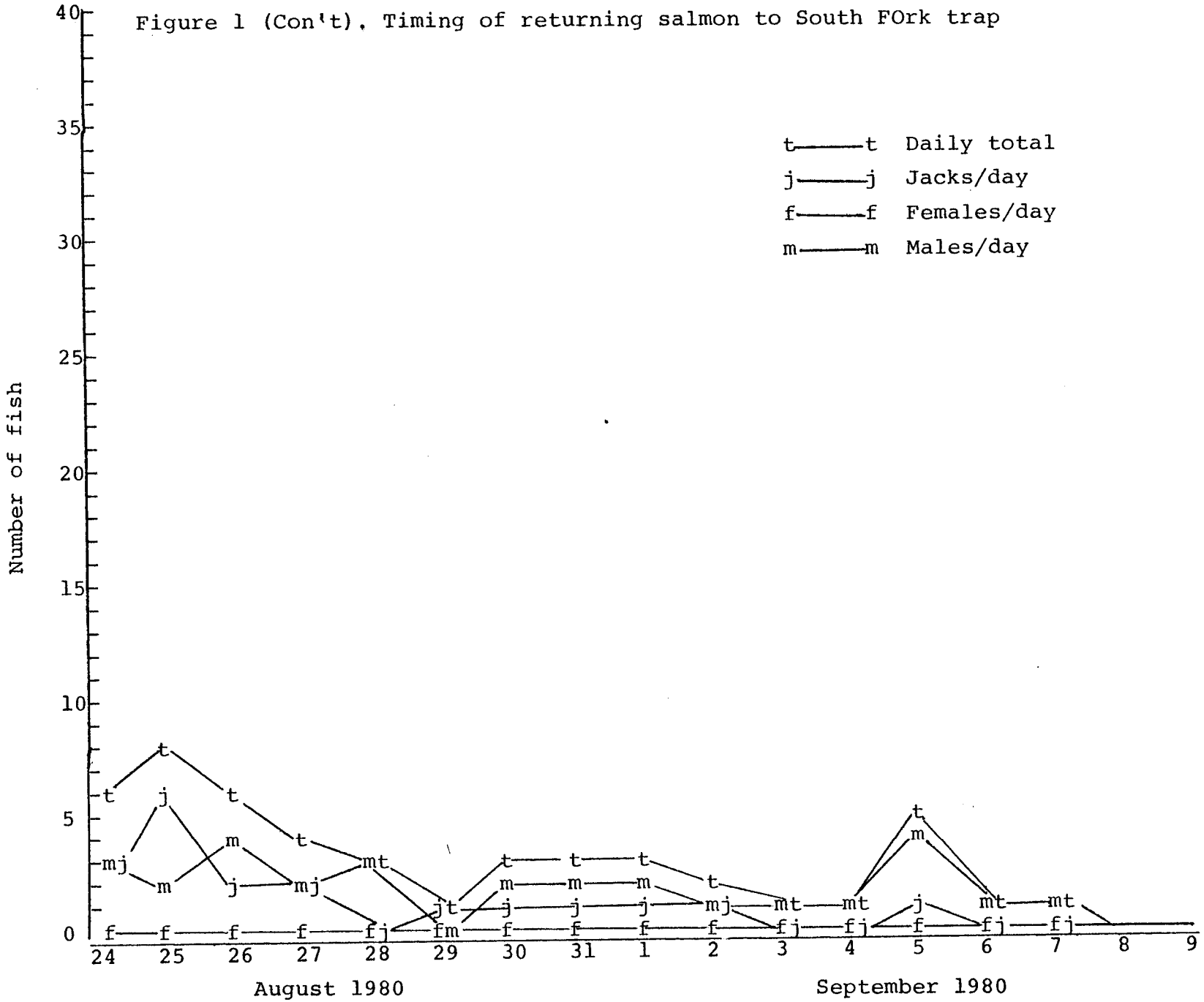


Figure 1 (Con't). Timing of returning salmon to South FOrk trap



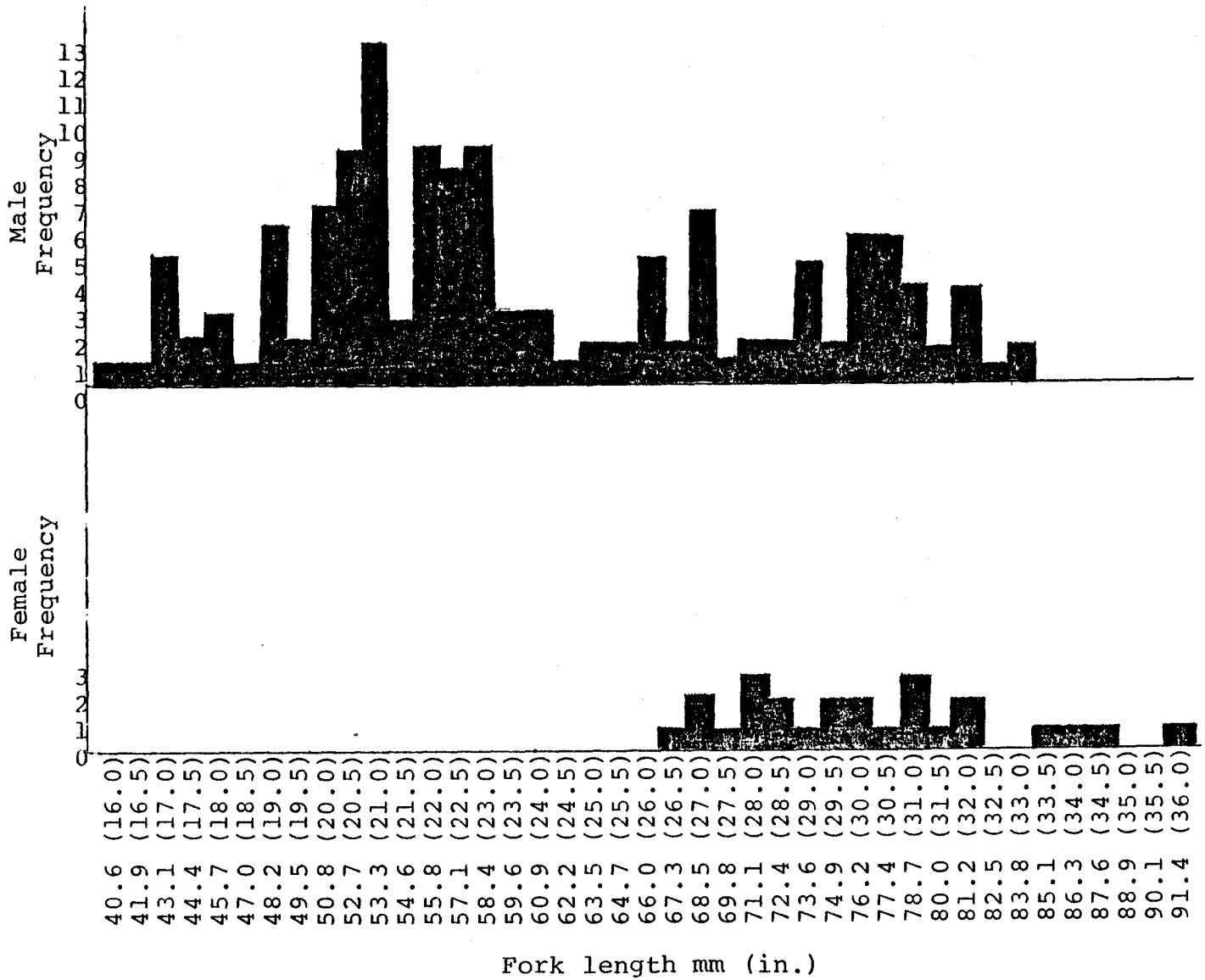


Figure 2. Length frequency of salmon spawned, salvaged, or released after ponding.

Some 128 of the returning adults were adipose clipped, indicating the possible presence of a coded wire tag. At spawning time, snouts from these fish were collected for tag recovery and investigation. Data on this recovery is included in Table 3.

During the period 18 August to 5 September, six lots of eggs were taken at the South Fork Satellite yielding 92,116 eggs, an average of approximately 3,684/ female (Table 4).

Since no Erythromycin injections were administered, all spawned and/or coded wire tagged fish that were fit for human consumption were salvaged, eviscerated, double wrapped and frozen to be given to charity.

Disease and Prophylaxis

Only one of the fish spawned at the satellite facility showed gross visible signs of a Bacterial Kidney Disease (BKD) infection. In an attempt to prevent a BKD infection in resultant fry and fingerlings, the eggs of the 1980 brood year were water hardened for one hour in a 2 ppm, active ingredient, concentration of Erythromycin (Gallomycin PFI, Abbott).

SPECIAL STUDIES

Vibrio anguillarum Vaccination

Approximately 120,000 (three lots of 40,000) of the brood year 1979 fish are scheduled to be coded wire tagged in October 1980, for a study investigating the benefits of vaccinating smolts against Vibrio anguillarum. The vaccination is to be carried out during February or March 1981.

Vat Color

Under the original construction contract, the hatchery vats were painted white. Although an excellent color for maintaining a proper level of cleanliness, it appears that these vats are too bright for starting summer chinook. Any movement near the vats caused a frenzy among the fish and a flight reaction that sent them to the nearest dark corner. If a grey epoxy paint can be obtained in time, the fish of brood year 1980 will be reared in a darker environment.

Jar Type Incubator

A hatching jar constructed of 30.48 centimeter (12 inch) PVC pipe, similar to those **in** use at Hagerman State Hatchery (Bud Ainsworth, Ralph Taylor, personal contact) and Dworshak NFH (Wayne Olson personal contact) will be tried on part of one egg take of the 1980 brood year, after the eggs have eyed. Results will be compared to eggs of the same lot remaining in the Heath incubators.

MISCELLANEOUS ACTIVITIES

Hatchery Completion Contract

A "clean up" contract was awarded to D. G. Quinton Company, Inc., Spokane, Washington.

=Table 3. Coded wire tag recovery data.

mm (in)	Code 325 Males 1979 Release (1-ocean)	Code 323 Males 1978 Release (2-Ocean)	Code 323* Sex Unk 1978 Release (2-ocean)	Code 323 Females 1978 Release (2-ocean)	Code 25 Females 1977 Release (3-ocean)
281 (sic)	1				
406	1				
431	4				
457	5				
482	4				
508	16				
533	10				
558	11				
584	**6**				
609	4	1			
635			1		
660		1		1	
685		3			
711	1	3		2	
736	1	4		3	
762		**9**		3	
787		**6**		3	
812	1	4			
838		2			
863					1

* Additional two fish in this code class, sex and length unknown. (from: Duke, R.C. personal contact)

Table 4. Egg takes and percent eye-up

Lot #	Date	Eggs Taken	Eggs Eyed	% Eye-up
1	8/18/80	12,300	9,600	78.0
2	8/21/80	4,176	3,960	94.8
3	8/26/80	40,640	29,808	73.3
4	8/28/80	9,176	3,240	35.3
5	9/2/80	18,648	12,096	64.8
6	9/5/80	7,176	3,432	47.8
Total		92,116	62,136	67.45

Number females spawned: 25
Eggs per female: 3,684.64

The major elements of this contract are: a security fence along Mather Road; installation of an incubation water pressure alarm system; corrections to drainage problems around the Office/Dorm and Visitor Center; addition of lighting at crowding basin, headbox, and garage area; and installation of a cover over the headbox structure.

Visitors, Programs and Tours

An estimated 2,500 visitors toured the hatchery this year. This number includes organized tours and slide shows given to Greenleaf Friends Academy, Wives of the Dairymens Association, Boise Senior Citizens, Duck Creek YACC, Cascade Cub Scouts, Treasure Valley Progressive Club, Engineers from CH2M-Hill and Walla Walla District Corps of Engineers, as well as several classes from McCall/Donnelly kindergarten, grade and high schools. A slide show was presented to the McCall Rotary Club.

Use of Hatchery Dormitory and Day Room

The dorm at McCall was utilized for 130 night accommodations, for professional and personal use, by Department employees and their colleagues. Day accommodations were also made available to several Department groups, needing a meeting place.

ACKNOWLEDGMENTS

The hatchery crew would like to acknowledge the following people for their respective contributions to our operations:

Charlie Knowles and Fred Hutchinson, Department of Lands, Bureau of Mines and Geology, Moscow, Idaho for analysis of hatchery water.

Harold Ramsey, IDFG, Hagerman; G. W. Klontz, DVM, U of I, Moscow; Joe Lientz, USFWS, Dworshak; and Charlie Smith, USFWS, Bozeman for investigations during disease outbreaks.

Wayne Olson, USFWS, and entire crew of Dworshak/Kooskia NFH Complex for care and efforts **in** holding and spawning the 1978 and 1979 returning adults.

Jerry Harmon, NMFS, and Lower Granite crew for assistance during trapping and transport operations at the dam.

Dick Bigej and John Hanson, USFWS, Boise, and Roy Taylor, CH_2M-Hill, Boise for assistance with construction deficiencies.

A special thanks to Bud Van Stone, Gary Willard, Jim Douglas, and Bob Burger, Lower Snake River Construction Office; and Vic Armicost and Wade Stampe, Walla Walla District Office, Corps of Engineers, without whose help the hatchery and satellite facility would not have been in operation this year.

Hatchery Staff during the fish year included: Larry R. Wimer, Fish Hatchery Superintendent II; Bill Hutchinson, Fish Hatchery Superintendent I; Pat Chapman, Fish Culturist; and laborers John Kirk, Jeff Lang and Kerry Wilkins.

LITERATURE CITED

Duke, R.C. 1980. Annual Report, Idaho Fish and Game, in print.

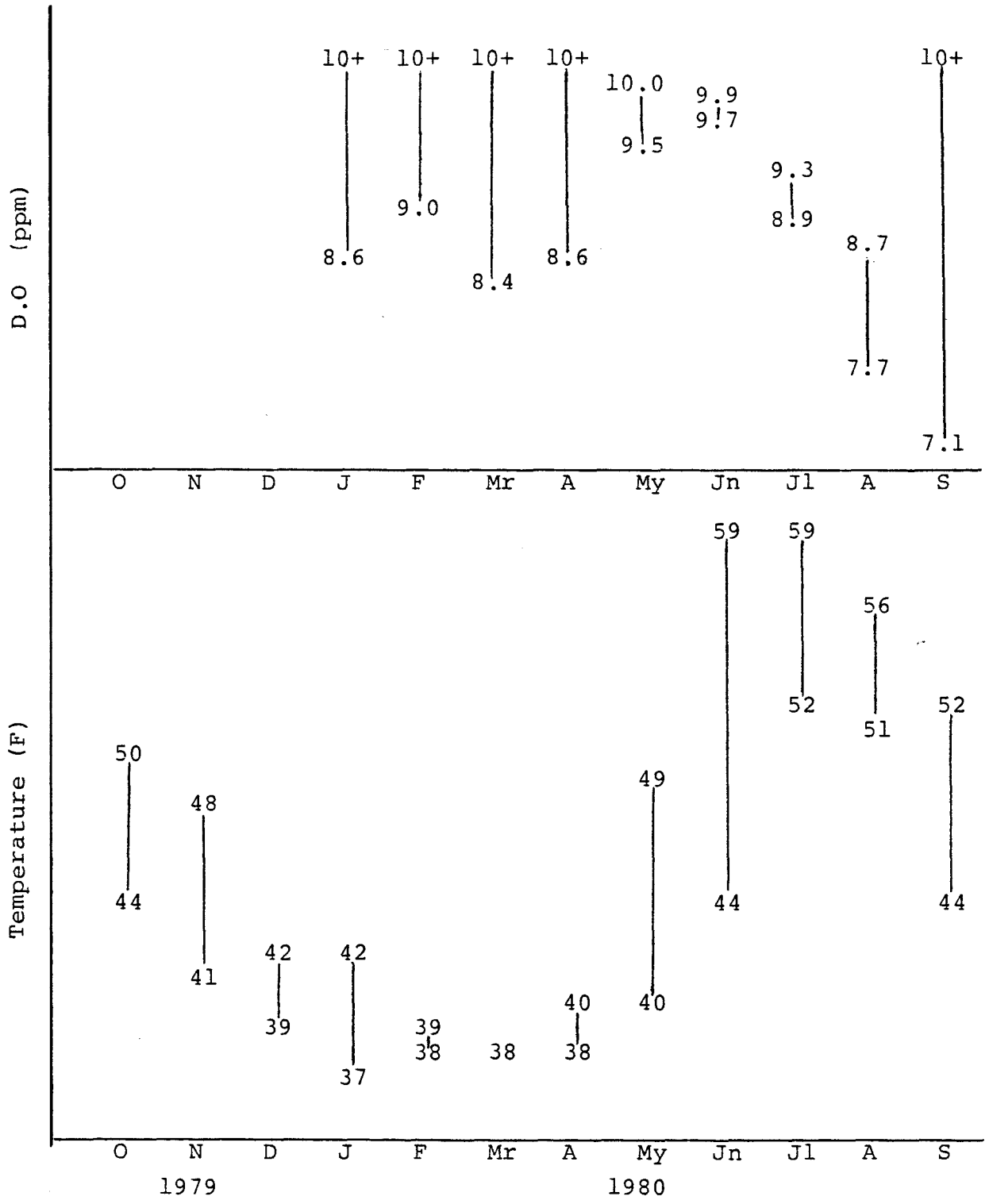
Hutchinson, B.G. 1980. McCall Hatchery Annual Report, Project 03-18-316, Idaho Fish and Game, in print.

Klontz, G.W. 1979. Fish Health Management: I Concepts and Methods of Intensive Aquaculture. Fishery Resources and Office of Continuing Education, University of Idaho, pp. 93-95.

Leitritz, E. and R.C. Lewis. 1976. Trout and Salmon Culture (Hatchery Methods). Fish Bulletin 164, State of California, Department of Fish and Game, pp. 61-62.

Wood, J.W. 1974. Diseases of Pacific Salmon, Their Prevention and Treatment, 2nd ed. State of Washington, Department of Fisheries, Hatchery Division, 82 pp.

APPENDICES



Appendix A. Temperature and disolved oxygen ranges throughout entire hatchery system (elevation: 5,000 ft.).

Appendix B ,

McCALL FISH HATCHERY WATER ANALYSIS

CONCENTRATION (ug/ml)

SAMPLE DATE	INLET	Cd*	Ca*	Cu*	Fe**	Pb***	Mg*	Mn*	K*	Na*	Zn*
1/8/80	Surface	<0.01	2.05	<0.01	0.03	<0.1	0.31	0.02	0.50	1.30	<0.01
1/8/80	Deep	<0.01	2.00	<0.01	0.03	<0.1	0.30	0.02	0.45	1.30	<0.01
1/14/80	Surface	<0.01	2.15	<0.01	0.05	<0.1	0.33	0.01	0.45	1.25	<0.01
1/14/80	Deep.	<0.01	2.00	<0.01	0.02	<0.1	0.32	0.01	0.45	1.35	<0.01
1/21/80	Surface	<0.01	2.20	<0.01	0.03	<0.1	0.34	0.01	0.55	1.50	<0.01
1/21/80	Deep	<0.01	2.00	<0.01	0.02	<0.1	0.31	0.01	0.45	1.15	0.01
1/28/80	Surface	<0.01	2.10	<0.01	0.03	<0.1	0.35	0.01	0.50	1.30	0.01
1/28/80	Deep	<0.01	2.20	<0.01	<0.02	<0.1	0.33	0.01	0.50	1.25	0.01
2/4/80	Surface	<0.01	2.20	<0.01	<0.02	<0.1	0.34	0.01	0.95	1.70	<0.01
2/4/80	Deep	<0.01	2.00	<0.01	0.03	<0.1	0.32	0.02	0.50	1.25	<0.01
2/11/80	Surface	<0.01	2.20	<0.01	0.02	<0.1	0.38	0.01	0.50	1.35	0.01
2/11/80	Deep	<0.01	2.10	<0.01	0.03	<0.1	0.34	0.02	0.65	1.35	0.01
2/18/80	Surface	<0.01	2.30	<0.01	0.07	<0.1	0.40	0.01	0.60	3.50	0.02
2/18/80	Deep	<0.01	2.00	<0.01	0.02	<0.1	0.32	0.01	0.45	1.25	0.01
2/25/80	Surface	<0.01	2.20	<0.01	0.02	<0.1	0.35	0.01	0.55	1.35	<0.01
2/25/80	Deep	<0.01	2.05	<0.01	0.02	<0.1	0.33	0.02	0.45	1.20	0.01
3/3/80	Surface	<0.01	2.15	<0.01	<0.02	<0.1	0.35	0.01	0.55	1.30	0.01
3/3/80	Deep	<0.01	1.95	<0.01	0.02	<0.1	0.31	0.01	0.45	1.15	<0.01
3/10/80	Surface	<0,01	2,25	<0.01	0.03	<0,1	0.35	0.01	0.45	1.25	<0.01
3/10/80	Deep	<0,01	2.05	<0.01	0.71	<0.1	0.33	0.04	0.50	1.15	<0.01
3/17/80	Surface	<0.01	2.10	<0.01	0.05	<0.1	0.46	0.01	0.55	1.65	<0.01
3/17/80	Deep	< 0.01	1.95	<0.01	0.05	<0.1	0.33	<0.01	0.45	1.25	<0.01
3/24/80	Surface	<0.01	1.95	0.01	0.03	<0.1	0.32	<0.01	0.45	1.20	<0.01

Appendix B . (Con't)

SAMPLE DATE	INLET	Cd*	Ca*	Cu*	Fe**	Pb***	Mg*	Mn*	K*	Na*	Zn*
3/24/80	Deep	<0.01	2.10	<0.01	<0.02	<0.1	0.33	< 0.01	0.45	1.20	<0.01
3/31/80	Surface	<0.01	2.05	<0.01	0.03	<0.1	0.33	<0.01	0.40	1.15	<0.01
3/31/80	Deep	<0.01	2.00	<0.01	0.17	<0.1	0.31	0.01	0.40	1.10	<0.01
4/7/80	Surface	<0.01	2.10	<0.01	0.03	<0.1	0.34	<0.01	0.40	1.20	<0.01
4/7/80	Deep	<0.01	2.00	<0.01	0.06	<0.1	0.32	<0.01	0.45	1.15	<0.01
4/14/80	Surface	<0.01	2.30	<0.01	0.06	<0.1	0.38	0.01	0.45	1.25	<0.01
4/14/80	Deep	<0.01	2.00	<0.01	0.07	<0.1	0.31	<0.01	0.50	1.25	<0.01
4/22/80	Surface	<0.01	2.95	<0.01	0.77	<0.1	0.68	0.04	1.05	1.75	0.02
4/22/80	Deep	<0.01	2.30	<0.01	0.90	<0.1	0.38	0.03	0.45	1.15	<0.01
4/28/80	Surface	<0.01	2.10	<0.01	0.11	<0.1	0.35	0.01	0.50	1.20	<0.01
4/28/80	Deep	<0.01	2.10	<0.01	0.25	<0.1	0.33	0.01	0.45	1.20	<0.01
5/6/80	Surface	<0.01	2.25	<0.01	0.75	<0.1	0.46	0.02	0.60	1.30	<0.01
5/6/80	Deep	<0.01	2.15	<0.01	0.19	<0.1	0.33	0.01	0.45	1.15	<0.01
5/12/80	Surface	<0.01	2.00	<0.01	0.04	<0.1	0.32	0.02	0.45	1.10	<0.01
5/12/80	Deep	<0.01	2.00	<0.01	0.06	<0.1	0.31	0.01	0.45	1.10	<0.01
5/27/80	Surface	<0.01	2.05	<0.01	0.08	<0.1	0.34	0.03	0.50	1.15	<0.01
6/3/80	Surface	<0.01	1.95	<0.01	0.07	<0.1	0.32	0.03	0.50	1.25	<0.01
6/9/80	Surface	<0.01	1.95	<0.01	<0.02	<0.1	0.32	0.02	0.85	1.50	<0.01
6/17/80	Surface	<0.01	1.95	<0.01	<0.02	<0.1	0.32	0.02	0.50	1.25	<0.01
6/24/80	Surface	<0.01	1.80	<0.01	0.05	<0.1	0.28	<0.01	0.45	1.10	<0.01
6/24/80	Deep	<0.01	2.00	<0.01	<0.02	<0.1	0.30	0.02	0.65	1.35	<0.01
6/30/80	Surface	<0.01	1.80	<0.01	<0.02	<0.1	0.28	<0.01	0.40	1.10	<0.01
6/30/80	Deep	<0.01	1.95	<0.01	<0.02	<0.1	0.31	0.03	1.00	1.05	<0.01

* $\pm$0.01

** $\pm$0.02

*** $\pm$0.1

Appendix C. Necropsy report form used at McCall Hatchery

MCCALL HATCHERY
NECROPSY REPORT

A. Pond (General)

1.) Date_____ e.) Pond #_____ 3.) Water stage _____

4.) Pond size _____ 5.) Flow _____ 6.) Pounds in pond_____

7.) Date last cleaned_____, 8.) Cleaning frequency _____

9.) Pond mortality_____

B. Fish (General)

1.) Species_____ 2.) Age _____ 3.) Length_____

4.) Weight, _____ 5.) Condition factor _____ 6.) Date last handled_____

7.) Diet _____ 8.) Pellet size _____ 9.) Feed rate_____

10.) Feed frequency _____

C. Water Condition & Chemistry

1.) Clear 2.) Turbid 3.) Water color_____

4.) Temperature_____ 8AM _____ 5PM.) D.O._____ 6.) pH_____

7.) Zn_____ 8.) Cu_____ 9.) Fe _____ 10.) Cd, _____

11.) Mn_____ 12.) Pb_____ 13.) Ca_____, 14.) Mg _____

15.) Na_____ 16.) K_____ 17.) Other_____

D. Comments

Appendix C (Con't). Necropsy report form used at McCall Hatchery

E. Fish Condition

1.) General appearance _____

2.) Arrangement in water _____

3.) Body surface _____

4.) Operculum _____

5.) Fins (indicate fins damaged) _____

6.) Caudal Peduncle _____

7.) Eyes _____

8.) Mouth cavity _____

9.) Gills _____

10.) Thymus _____

11.) Musculature _____

12.) Body cavity _____

13.) G.I. tract _____

14.) Pyloric caeca _____

15.) Liver _____

16.) Spleen _____

17.) Gall bladder _____

18.) Air bladder _____

19.) Sex organs, _____

20.) Kidney _____

21.) Heart _____

F. Other Signs or Conditions Noted

Performed by:_____